A Combination of Earth Orientation Observations: SPACE93

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A Kalman filter has been used to combine all publicly available,
independently-determined observations of the Earth's orientation taken
by the modern, space-geodetic techniques of very long baseline
interferometry (VLBI), satellite laser ranging (SLR), lunar laser
ranging (LLR), and the global positioning system ((GPS). Prior to
combining the data, tidal terms were removed from the UT1
measurements, outlying data points were deleted, series-specific
corrections were applied for bias and rate, and the stated uncertainties
were adjusted by multiplying them by series-specific scale factors
Values for these bias-rate corrections and uncertainty scale factors
were determined in an iterative, round robin type approach wherein
each data set was compared to a combination of all other data sets
The bias rate corrections thus determined are such as to make the data
sets agree with each other in bias and rate, and the uncertainty scale
factors thus determined are such as to make the residual of each data
set (when differenced with a combination of all others) have a reduced
chi-square of one. After applying to each data set the bias-rate
corrections and uncertainty scale factors that were determined for them
as described above, a final bias-rate correction was applied in order to
place SPACE93 within that reference frame determined by the IERS
combination EOP(IERS)90 C 0.4. The bias-rate corrections and
uncertainty scale factors that were applied to the series prior to their
combination into SPACE93 are given in the following table.

ADJUSTMENTS To DATASETS

DATASET NAME	BIAS (mas)		RATE (mas/yr)		UNCERTAINTY SCALE FACTOR	
	LAT	UT0	LAT	UT0	LAT	UT0
LLR (JPL 93M01)	LAT	UT0	LAT	UT0	LAT	UT0
McDonald Cluster	1 2"/0	1.703	0 676	-0.225	1.006	1 141
CERGA	-0 289	1 635	0 075	.0174	1 253	1 120
Haleakala	1 346	1(M?	0 219	-0.2 14	1 099	1 153
DSN (JPL 93R01)	T	V	T	V	T	V
CA Spain Cluster	0 626	-1.00?	-0.038	-018 1	1195	1099
CA Australia Cluster	-0 561	1.000	-0 192	0 076	1.213	1 115
('D)T'((ii.liw?)	T	V	T	V	T	V
Westford H Davis	2 746	-2 589	0 587	0 192	0.812	0 900
Westford Mojave	0 659	1 094	0 007	0 016	1 746	0 970
	PM X	PM Y	UT1	PM X	PM Y	UT1	PM X	PM Y	UT1
('D)T'((ii B9??)PMX	PM Y	UT1	PM X	PM Y	UT1	PM X	PM Y	UT1
Multi	0155	-1739	1.0117	0 129	0 049	.0 0N/	1 438	1.43?	1 461
UTCSR(93L01)PMX	PM Y	UT1	PM X	PM Y	UT1	PM X	PM Y	UT1
LAGEOS	0 021	0.030	0 032	0 162	0 864	0.825	
IRIS(19 JAN 94)PMX	PM Y	UT1	PM X	PM Y	UT1	PM X	PM Y	UT1
Intensive		1 9D7		0.012	--		1 160
GPS (SIO93P01)PMX	PM Y	UT1	PM X	PM Y	UT1	PM X	PM Y	UT1
Scripps	1 007	-1 , 730	0017	00?0	1 463	1.403	
GPS(JPL 92P02)PMX	PM Y	UT1	PM X	PM Y	UT1	PM X	PM Y	UT1
JPL FLINN	0.717	-1.578	0.017	0 0?0	2 006	1 649	

REFERENCE DATE FOR RATE ADJUSTMENT IS 1988 0